UNIVERSITAS INDONESIA

Risk Mitigation Process: A Case studiy on Marine Offshore Construction Project at PT. Dwisatu Mustika Bumi, Jakarta, Indonesia

SKRIPSI

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FAKULTAS TEKNIK
PROGRAM INTERNASIONAL
TEKNIK SIPIL
DEPOK
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Diajukan sebagai salah satu syarat untuk memperoleh gelar Sarjana Teknik

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Demikian Surat Keterangan ini dibuat agar dapat dipergunakan dengan sebagaimana mestinya.

Depok, 07 Januari 2013
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Risk Mitigation Process:

A Case Study on Marine Construction Project

at PT.Dwisatu Mustika Bumi. Jakarta, Indonesia

Riggy Haloedea (0606142654)

A project report submitted in order to pass requirement

Bachelor of Engineering Degree (Sarjana Teknik Sipil)

Civil Engineering Department

Engineering Faculty

University of Indonesia

December 2012

QUT Academic Record

Bachelor of Engineering

EN40 Version 1 Course Attempt 1

Study Area A
Civil and Construction Engineering Major

Study Area B
Civil Infrastructure Second Major

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Advanced Standing

Type	Unit Title	Grade	Description	Credit Points Achieved
Exemption				
ENB273.2	Civil Materials			12
UDB312.1	Contract Administration			12
UNI960.1	Unspecified Exemption			96

Units of Study

Unit Code	Unit Title	Grade	Description	Credit Points Achieved
Semester 1, 2009				
ENB272.1	Geotechnical Engineering 1	4	Pass	12
ENB372.1	Design and Planning of Highways	5	Credit	12
ENB375.1	Structural Engineering 2	3	Fail	0
ENB378.1	Water Engineering	4	Pass	12
Semester 2, 2009				
ENB201.1	Fluid Mechanics	4	Pass	12
ENB275.1	Project Engineering 1	4	Pass	12
ENB276.1	Structural Engineering 1	4	Pass	12
ENB371.1	Geotechnical Engineering 2	4	Pass	12
Semester 1, 2010				
ENB277.2	Construction Engineering Law	4	Pass	12
ENB375.2	Structural Engineering 2	5	Credit	12
ENB381.2	Civil Engineering Construction	4	Pass	12
UDB313.1	Programming and Scheduling	4	Pass	12
Semester 2, 2010				
ENB373.2	Design and Construction of Steel Structures	5	Credit	12
ENB376.2	Transport Engineering	4	Pass	12
ENB382.2	Estimating in Engineering Construction	4	Pass	12
ENB481.2	Civil Engineering Project Management	6	Distinction	12
Semester 1, 2011				
BEB701.2	Work Integrated Learning 1	4	Pass	12
BEB801.2	Project 1	4	Pass	12
ENB471.2	Design of Concrete Structures and Foundations	4	Pass	12

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ENB474.2	Finite Element Methods	2	Fail	0
ENB476.2	Civil Engineering Design Project	4	Pass	12
UDB214.1	Professional Studies 2	6	Distinction	12

Semester 1, 2012

BEB802.2	Project 2	5	Credit	12

Course Grade Point Average (GPA): **4.250**

Bachelor of Engineering (Civil and Construction)

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Conferred on 26 July 2012

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17-Jul-2012

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To Whom It May Concern

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Course Commencement Date:	21-Jul-2008
Course Completion Date:	06-Jul-2012

This is to certify that, according to Queensland University of Technology records, the above named student has completed the **Bachelor of Engineering {Civil and Construction}** award on 06-Jul-2012.

Studies were undertaken on a full time, internal basis. This award will be conferred in July 2012.
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QUT

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Chancellor

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26 July 2012

6963625

Queensland University of Technology

Brisbane Australia

Approval form

Risk Mitigation Process:

A Case Study on Marine Construction Project at Dwisatu Mustika Bumi, Co. Jakarta, Indonesia

A project report submitted in partial fulfilment of the requirements of the subject BEB802: PROJECT 2 in the Bachelor of Engineering Degree. School of Urban Development, Queensland University of Technology, 25 June 2012.

Author:

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Project Supervisor:

Bambang Trigunarsyah

Queensland University of Technology (QUT). Brisbane, Australia.

I declare that the work presented in this report is my own work except where due reference or

Acknowledgement is given to the work of others.

Signed: ____________________________ Date: _______________

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Firstly, I addressed my gratitude to Allah SWT for his widely blessings throughout a year learning experiences. From the bottom of my heart, I would like to put my gratitude to my beloved parents Ade Halim and Sjafrudin Halim and my lovely sister Jade Sjafrecia Petroceany and brother Deafitra Fajri for their love, support and encoureagement during my time studying in QUT.

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Abstract

For the last 10 years, the oil prices are rising in a substantial number, due to the fact that oil now are already in its secondary recovery, so that the production are also need to be increased by a new technology or an economical processes. Seeing transportation as the alternative, now transport by a pipeline foreseen as one solution. With the pipeline is mostly located below sea bed or in land, created the need of oil and gas industry to assess some risks contained in order to build the project. In this matter, risk management (RM) becomes a very important issue and also need to be improved.

In general this research are trying to identify typical risk that lead to subsea pipeline installation down time(DT) and identify potential response to those risks related to those typical project environment. Furthermore DT is used to measured risks that are usually happened during the operation time which in this case was installation. DT has tied relation to productivity, since offshore construction which generally could not possibly be carried during bad weather. That bad weather can also stretch the transportation of crew and material during that time. This will automatically halt the construction phase during heavy weather.

Keyword Mentioned

Bad weather:	Sea State which operations cannot be performed
Client:	CNOOC SES Ltd
Contractor:	PT.Dwisatu Mustuka Bumi(DMB)
DT:	Idle Operation time on site that operation can't be performed with all equipment and crew on hire
DMB:	PT.Dwisatu Mustuka Bumi
Equipment:	Vessel or Ship and Barge, Machinery, Cranage, and Other work support apparatus
Installation:	Construction or Tie-in of the Structure or machinery
J-lay method:	Pipe laying operation from vertical position
Manufacturer:	Party which manufactures the equipment / materials specified and ordered by PT.Dwisatu Mustika Bumi
Manifold:	Pipe branching that includes T-Junction
Offshore:	Out in Open seas
Pig catcher:	Sludge Cleaner End or Catcher
Pipeline:	Pipe that transport Fluid material between platform or between facilities
Project :	EPCI Pipeline Replacement 16" from titi-A to Karmila-A
Riser:	Pipe Connector that connect from sea bed to platform
S-Lay method:	Conventional Construction method from horizontal position
Subsea:	Bellow the seabed or under the seabed
Subcontractor:	Party which provides services to perform part of the project scope of work on behalf of PT.DwisatuMustikaBumi
Third Party:	Certification agency appointed by PT.Dwisatu Mustika Bumi or by Client
Vessel:	Heavy Machinery or Processing facilities
Vendor:	Party which supplies equipment / materials or services specified and ordered **by PT.Dwisatu Mustika Bumi**

Abbreviations

- A & R : Abandonment and Recovery
- AHT : Anchor Handling Tug
- DIA : Diameter
- ERP : Emergency Response Plan
- FIFI : Fire fighting
- FPSO : Floating Production Storage Operation
- HSE : Health, Safety and Environment
- HAZOP :Hazardous Operation
- ISO : International Organization for Standardizations
- LB : Lay Barge
- NDT : Non Destructive Test
- OD : Outside Diameter
- QA / QC : Quality Assurance and Quality Control
- PM :Project Management
- PMT :Project Management Team
- RACI : Responsible, Accountable, Consult, Inform (responsible assignment matrices system)
- ROV :Remotely Operated Vehicle
- WB : Work Barge

1. Introduction

1.1 Background

In offshore pipeline installation, the most common problem occurs in operation time is when it interfere production time cycle. However, the production or installation times of a structural which include sub-sea pipeline are mostly takes place due to downtime(DT). These DTs are happening because of the several matters i.e.: bad weather, machinery or equipment failure, and material transport.

1.2 Aim and Objective

Risk mitigation has become a top priority list within every activity on the oil companies. While PT.Dwisatu Mustika Bumi (DMB) serves as national construction company provide marine, offshore and oil and gas industries services, risk mitigation in the business has to be account in order to deliver client's satisfaction as well as to gain revenue. DMB is chosen as a case study are because the needs of improving risk management (RM) process and to apply RM as a tool to manage DT in its operation. The aim of this report is to investigate the use of RM system to manage DT in offshore pipeline installation project.

The objectives are to:

- identify typical risk that leads to subsea pipeline installation DT
- identify potential response to those risks

1.3 Research Methodology

In this writing of the thesis will include the RM as a system that are used in the company. The RM system that are used and known in the company will be compared to the literature and also best practice known in the related field. The RM as a system will be included in the discussion but not limited to risk that are scattered throughout the project and its stake holder. This section of the thesis will include two part which the first part will explain how the research structure are made and the second part focused on comparing the company RM system to the literature which already been research in the chapter 2. The chapter are mainly literature review which can be used as a guideline to compare the company practice and the known practice in the overall based.

1.4 Research Structure

The approach given in this report explain how the relationships between DMB as a main contractor and other stakeholder in the project including client as the project initiator. By using RM system, main contractor such DMB take roles as controller through a supervisory from client point of view and based on client approval. Furthermore, the sub-contractor which involved in this project also had their risks management system that will be integrated to the DMB RM System. Even though some of the subcontractors involved are also DMB subsidiary also has a different approach on how they look RM (i.e.: marine spread that are involved in the projects have a different kind on rules and standard involved).

This thesis will examine the methodology that has been done during the project phase in form of a general RM assessment done by the project management team. Moreover, those assessments are documented on project team as a base-line to monitor and response the risk during the project time line. Those timeline are in line with the project cost in a typical pipeline project. All of the productivity that is reach during the project can be measured by a daily productivity rate. The events that are happened in the site in every timeline in the project can affect the productivity in that particular date. Impact assessment then can be measured to mitigate the productivity DT in some case that can be seen and resolve. Meanwhile, the impact reduction can be done by in two criteria which can be done based on the cost or in the probability of it occurrences in the project time window.

1.5 Expected outcome

RM system would be tools in approaching a better decision making in most project. By understanding the RM as system the decision making could be done in more efficient manner in terms of cost and time.

1.6 Report structure

This report contains of five chapters. In this chapter, background present to be the initial information of report. Then it follows by aim and objective. This research also set to has certain outcome. The rest of report presented in this following order: As chapter two elaborate literature review for DT management, RM and RM system. In chapter three, research method expands the methodology use in this research paper. It acknowledges the type of research, research process and research strategy. Chapter four discuss specific area of risk with case studies, mitigation reaction based on risk level, mitigation responsibility, cost variance and mitigation cost. Finally, the last chapter closes the paper by having conclusion and recommendation to this issue.

2. Literature Review

2.1 Introduction

In this chapter generally will summarized previously released literature and books that will help to more understand the topic of this report. Three main focus are the typical subsea pipeline project, DT, and RM. This three main topic will be related to project risk response that can be measured in two main criteria which was cost and time based.

2.2 General Overview of a Sub-Sea Pipeline Project

Submarines pipeline are generally a pipe that used to transmitted petroleum product, gas, water, slurries, and effluents. A sub-sea pipeline project is mostly a pipeline that positioned below sea level to carry liquid material from facilities to facilities. The facilities can be a production facility or possibly a processing plant. The pipe installations will also include the installation of three risers and the associated instruments including a pig catcher and pump at the end of the riser (Gerwick, 2007; Bai et al., 2005).

Pipelines and risers are used for a number of purposes in the development of offshore hydrocarbon resources (Chakrabarti, 2003).These include e.g.:

- Export (transportation) pipelines;
- Pipeline bundles.
- Flowlines to transfer product from a platform to export lines;
- Water injection or chemical injection flowlines;
- Flowlines to transfer product between platforms, subsea manifolds and satellite wells;

2.2.1Fabrication at yard

Fabrication yard are functions to make a point to supply the project. This is a part of supply chain management that are needed to full fill project demand. The fabrication yard will act as the key point to load out material, supply boat and crew change. These facilities will act as fabrication of substructure for i.e.: manifold, or anchor, or other structural or mechanical that needed during the project.

2.2.2Construction

During the construction a pipeline can be done by two methods basically. First types are S-lay method or J-lay method. Those two types of the vessel are based on how the pipelines are joints together and how the arrangement to meet the production is made (Gerwick, 2007; Bai et al., 2005; Chakrabarti, 2003).

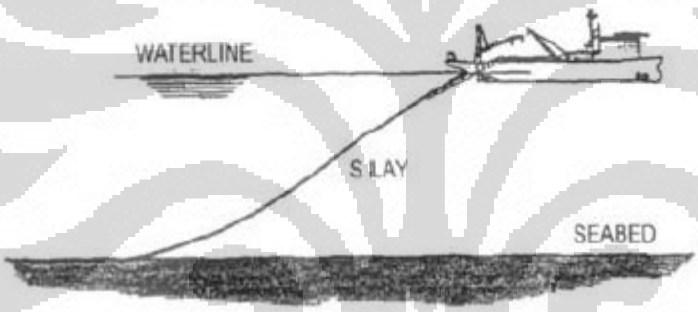
Concrete block or pipe sleeper for stability

First phase for the construction sequence are mostly preparing and surveying the bottom of the sea by side sonar scan or with remotely operated vehicle (ROV). This will ensure the bottom profile of the sea bed to be determined before construction is done. Furthermore, these will ensure and confirm how many supports that will be needed to ensure stability of the pipeline if there are any creeks that have to be passed. If there are any creeks that are too deep it will be prone to crack (Gerwick, 2007).

Pipeline installation

Some installation methods that are can be adopted for a subsea pipeline project given as following techniques (Bai et al., 2005):

1. Conventional S-lay barge (figure 1)
2. Bottom pull method
3. Reel barge
4. Surface float
5. Controlled subsurface float
6. Controlled above bottom pull
7. J tube from platform
8. J lay from barge
9. S-Curve with collapsible buoyancy



(Source: Bai et al., 2005)

Figure 1 S-lay method

Riser Installation

Riser is mainly a rigid or flexible pipeline that connects the pipe on the bottom of seabed to the topside of the platform facility whetter it was a production or exploration platform. This installation can be done with several methods undersea welding or above sea level welding from the construction vessel. The first method is done by having a dry welding chamber on the seabed by a welding diver or can be done with wet welding without chamber. The second method is done by welding the elbow from the construction vessel and lowering the welded section by an appropriate careenage method to lower it and secured it to the platform jacket with a clamp by diver (Chakrabarti, 2003).

2.2.3 Diving Operation

Diving operation are used in construction to support the installation, this will ensure the positioned pipeline in the sea bed to be correct as it was meant by design. Furthermore there are two type of diving that can be done: 1) 'Air Diving' and 2) 'Saturation Diving'. Beside for survey, diving can also be used to support the work by means to make a correction or to make an underwater work. Those underwater works such as bolt fastening, clamp installation, or manifold installation (Gerwick, 2007).

The distinction between these two diving system are lays on the depth of the sea. Those are caused by at certain depth different that human body can cope with. In the shallower water they only used an air diving which only used oxygen for breathing. Other than that the diver should go to hyperbaric chamber during it diving period. Those things are done to maintain the stability of the liquid in the diver body. Certain gases are inhaled by the diver in the process in deep sea dive. Diving bell is used to accelerate the diver ascending to the sea floor (Gerwick, B.C, 2007).

2.3 Downtime Management

Downtime (DT) in general terms in construction is a loss time in a construction phase that can result a delay. This production rate can be measured in the project control or in deliverable that can be measured in client payment. Furthermore, DT also can be call as an idle time on site with all the construction crew can't do anything due to critical resource unavailability.

As has been said in the journal of construction engineering and management by ASCE on October 2009,"machine DT is mainly critical problem faced by a highway contractor. Attempts to reduce DT often resulted in failure due to dynamic behaviour between equipment management practices and DT." This also can be used in the sub-sea pipeline case which have the similarity on how the function of the productivity in its cycle. Thus, the only main differences between these two projects are mainly in the commodity that are transported and the material they used to finish the project.

DT resulting in machine breakdown during the operation is a prime concern in contractor's point of view (Presertrungruang and Hadikusumo, 2007). However, in the a pipeline construction there are other variable that should be counted during those time which was the weather in this case can be wave, heavy wind, or other unpredictable weather.

DT caused by non-availability of equipment and equipment breakdown has non-trivial impact on the performance of construction project. It suggested that construction companies need to adopt proactive equipment management and maintenance programs to minimize the impact of DT (Mahdav and Monseo, 2004).

There is a little doubt that increased efficiency of mechanized construction method would reduce construction cost and raise productivity. Many factors affect the productivity of construction equipment, however. Some factors are easily identifiable prior to construction, while other is unanticipated and affect equipment productivity negatively. DT caused by non-availability of equipment and equipment breakdown is among the most common unanticipated factor that have a non-trivial impact on the equipment productivity and project and organizational performance (Edward et al., 1998)

The Location of site, for instance may limit the type and size of equipment that can be transported to site. Moreover, the remoteness of construction site may affect the repair time of equipment by affecting communication and the prompt procurement of parts (Day and Benjamin, 1991).

Factor that are related to equipment are its age, type, quality, complexity of operation, and degree of usage. A company procedures, policy, and site management action can have significant influence on the selection, use and operation of equipment. It has been reported that the risk of equipment breakdown is related to complexity and sophistication of the mechanical and hydraulic system of a piece of equipment (Arditi et al., 1997; Elazouni and Basha, 1996)

Crew level factor are related with human aspect of crews who are involved in the maintenance, operation, and production process. This factor will include skill level of the operator and mechanics, fatigue, morale, and motivation. An operator's skill is one of the most important factors and it affects the operator's performance and the direct cost of DT through job efficiency (Arditi et al., 1997; Edward et al., 2000; Elazouni and Basha, 1996)

High swell or weather factor can also cause down time. This include the events that are unanticipated by project participant, particularly those related to natural calamities. Such event may result delay in equipment maintenance or operation in general. Additionally, adopting proper safety practices and increasing security measures can control event such as vandalism and accident during those time.

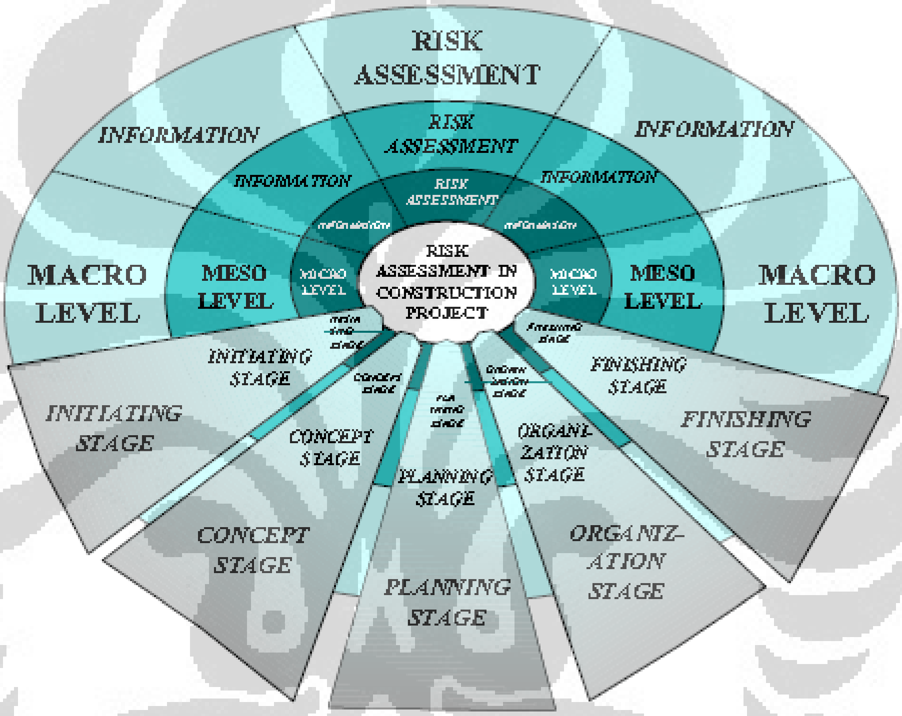
The equipment policies of a construction firm reflect the priorities set by top management and carry significance in terms of resources allocation and strategic planning (Sozen and Giritli, 1987). The Frequent disruption of work can also erode crew morale (Eden et al, 2000). This effect can also lead to frequent stoppages and the imposition of additional learning requirement for crew, which slow down project progress (Piper and Vachon, 2001).

DT costs are the monetary values for idle equipment and the time when it is unavailable (Pathmanthan, 1980). DT cost can be categorized into two broad categories: tangible and intangible cost (Vorster and De La Garza, 1990). Tangible cost includes the cost of labour, materials, and other resources accrued for repairing equipment or during bad weather. Intangible costs are mainly the cost on liquidated damages or late-compensation charges (Pathamanatan, 1980; Tsimberdonis and Murphee, 1994).

When the machines fails during it operations, it is said to be "down or unavailable" which means that it is waiting for repair and thus incurring down time (Nagi, 1987). Typically, DT duration consist of three major component, including (1) administrative time: time required for communication between the end user to the site office or head office (2) supply time: time when repaired is delayed due to non-availability of spare parts and material necessary to perform maintenance (3) active repair: time when technician or tradesman working on the equipment to commission it including both preventive and corrective maintenance (Komatsu, 1986).

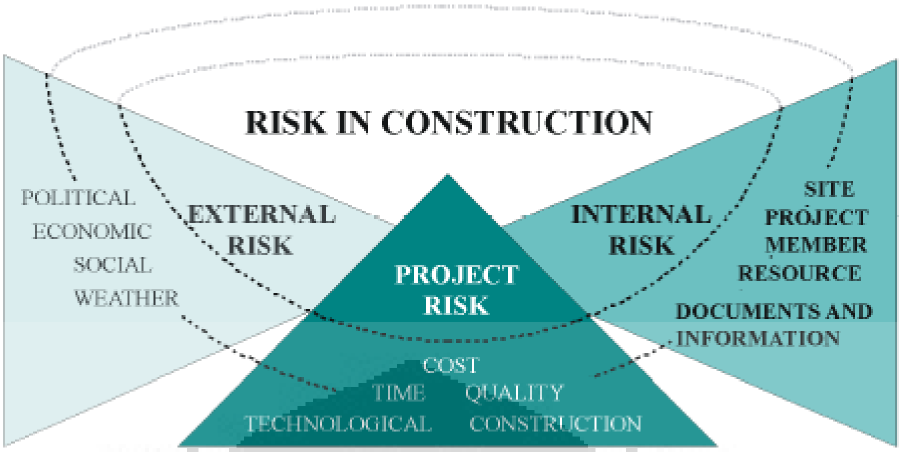
2.4 Risk Management

In 2007 Hallowell and Gambatese proposed: "The safety risk capacity associated with a safety program element is defined as the collective safety risk mitigated by the element. Alternatively, the total risk capacity of a safety program is equal to the sum of the risk mitigated by the collective elements that comprise the program." For the ease of the RM system we can see figure 2 and figure 3 as the set of intersection of the system.



(Source: Edmundas Kazimieras Zavadskas1, Zenonas Turskis2, Jolanta Tamošaitien_3)

Figure 2: Risk assessment divided according to object life cycle environment



(Source: Edmundas Kazimieras Zavadskas1, Zenonas Turskis2, Jolanta Tamošaitien_3)

Figure 3: Risk allocation structure by level in construction object

2.4.1 Risk Definition and its component

Based on Australian standard Risk Management-Standard Australia 2004 "Risk is the chance of something happening that will have an impact on objectives and risk management is the culture, processes, and structures that are directed toward realizing potential opportunities while managing adverse affect that follow". Risk could also come from many sources: temporary project team that is collected from different companies, construction site, etc. Moreover, the size and complexity of construction objects are increasing which adds to the risks. This is in addition to the political, economic, social conditions where the object is to be undertaken. Object risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective, such as time, cost, and quality (Project Management Institute Standards Committee, 2004). Project risks are uncertain events or conditions that may have impact on project objectives (Project Management Institute, 2000) a risk has a caused and, if it is triggered, a consequences. RM is a formal process directed towards the identification of, assessment of, and response to project risks (Project Management Institute, 2000)

Baloi and Price (2003) study on risk shows classification from perspective of contractors and focus on risks that are project related and may affect project performance in terms of cost. By conducting an extensive literature review and interview with construction contractor, some risks has been identified as follows: global risk (e.g. financial, economic, political, legal, and environmental), internal risk (e.g. design, construction, management, and relationships) and force major risks.

There are many undefined risk in the area of operation caused by the heavy weather that will make high swell in wave which can be ranged from 2 meters to 5 meters depends on the area of operation. The most severe area that could be used as a bar chart of the safety operation regulation or safety requirement that have the highest standard is mainly the North Sea.

As an illustration of some of the risk at marine transportation was at the grounding of the *Exxon Valdez* and capsized of the *Herald of Free Enterprise* and the *Estonia* passenger ferries. The challenge and the key point will be how to avoid the catastrophe, to erase or reduce the possible consequences from environmental damage to loss of human life, and also how the risk mitigation will act as the tool to manage the consequences (Merrick and Dorp, 2006).

The principal of risk *management* is widely used in construction industry, applied at various stages during the procurement process. It has been shown that proper application of risk management techniques can significantly improve the investment performance of construction projects (Flanagan and Norman, 1993). The phases of a project during which risk management can be applied have been identified as:

- Initial appraisal
- Outline or sketch design
- Detail design
- Contract strategy
- Construction

Risk are mainly basic uncertainties which concern clients as project initiator that held the most major investment in their facilities. These facilities are mostly pipelines and its supporting features such as manifold and other supporting component. The concept of risk management in the general sense is derived from flow of the project or similar project. That concept is based on information that gathered by historical data, prediction about the future, and the decision maker's subjective judgment; and therefore the uncertainty can be defined by some of these following (Bourke, 2007):

- Time risk
- Cost risk
- Quality risk

As has been listed by Flanagan and Norman (1993) those above risk which may affect construction project include the following:

- Failure to obtain approval from relevant authorities (e.g.: government agencies, statutory bodies, etc) within the time allowed on the project.
- Unforseen adverse ground conditions(rock, sand, and undersea current)
- Bad weather in monsoon season
- Industrial action
- Unexpected prices rises
- Accident
- *Force majeure*
- Late production of design information (which comprise to integrated project management)
- Labour, material and/or equipment shortages

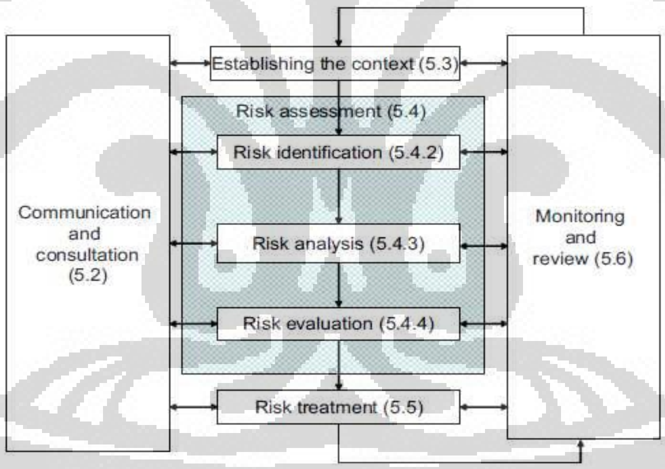
- Disputes between project stakeholder(i.e.: contractual term, agreements, and addendum from the initial contract)

As stated by Burke (2007): "As we can see risks are mainly can be defined as Uncertainty that related to a probability that something will happen in the future. This uncertainty can be classified as a bad for some case, but with some entrepreneur ingenuity, can be turned around to become opportunity". Those can be turned around if all the risk can be foreseen from the beginning of the project. These are mainly related to risk management plan that been prepared by the project team." In risk process, to make the risk management plan will include some of these following (Kendrick, 2010).

2.4.2Risk Management Concept

The risk management process be effectively used for traditional risk management schemes such as risk control. Risk control can be described as the five-stage processes (Han et al., 2008) are:

- Identification;
- Analysis;
- Evaluation;
- Response;
- Monitoring.



(Source: International Organisation for Standardization. 2009)

Figure 4: Risk management process outline

Figure 4 is determining RM process that ensures the risk management are included in the project development and project plan execution:

1. Risk identification
2. Risk analysis and quantitative risk analysis
3. Risk response planning
4. Risk monitoring and control

2.4.3 Risk Identification

As has been mentioned by Shen (2001), a project risk can be indentified in four major groups:

1. Business Risk- associated with capital expenditure, possible income, operating expenses and property value. In common senses it is related to the return on investment.
2. Pure Risk- static risk, non-market risk, or unsystematic risk.
3. Speculative risk- dynamic risk, market risk or systematic risk.
4. Financial Risk- relates to the lost of financial capital

In identifying risk that might occurs in a construction project, it shall define relation the project with other element such as the stakeholder involvement, capital involvement, and its component that included in the project. Those risk that has been identified than can be breakdown into more specific area of the project regarding the risk holder, risk time, and risk probability. After it has been identified those risk register can be spread throughout the whole project to be managed by the risk holder in the project structure which can be a person, department, company, client, vendor, or even subcontractor. To control the risk that has been listed and its extension, a significant outcome in managing the risk related to the project needs an integrated approach by the Project Management Team (PMT). Therefore, the focused on the project outcome and objectives as client and company responsibility changes could be controlled.

Furthermore, project are exposed to both internal risks (financial, design, contractual, construction, personal, involved parties and operational risks) and external risks (economical, social, political, legal, logistical and environmental risks). All the risks may influence cost, schedule or quality of the project in negative ways (Charoenngam and Yeh, 1999). Therefore risk management should be well priorities and taken as an integrated part in project management.

Risk management is an integral part of management of a project since unmanaged or unmitigated risk are one of the primary cause of project failure (Lyons and Skitmore, 2004). Risk management are part of project that shall not be ignored in each project. Accordingly, AS/NZS 4360:1999 (Australian Standard, 1999) outline a generic risk management process consisting of seven steps: establish the context; identify risk; analyse risk; evaluate risk; treat risk; monitoring and review; communicating; and consultation.

2.4.4 Risk Analysis

Collaborative work involves quite different types of risks and opportunities than technical core tasks. Das and Teng (1996) made a distinction between a performance risk that relates to accomplishing the technical objectives and a relational risk that involves reaching the goals of the social aspect of performance. In large and complex construction projects, relational risk is a major determinant of project success; collaborative work in project implementation has a potential for either significantly adding value or significantly withholding it (Smyth and Pryke, 2008).

In practice and in a common project management bodies of knowledge (such as that of Project Management Institute, 2008), relational risk and risk management (RM) are better known through various indirect concept that address specific part of the issue or an intended solution, such as stakeholder management or communication management.

Relational risk relates to achieving the goals of the collaboration, and performance risk relates to achieving the goals of technical undertaking, provided that the collaboration functions properly (Das and Teng 2001). So far, relational risk and relational RM have been discussed in the context of strategic alliances (e.g., Salonen 2006; Das and Teng 2001), and the consequences of relational risk has been linked to the possibility of worse than expected outcome of collaboration. Focal concerns in relational risk include opportunistic behaviour and inequities in payoff and even the perception of such non-collaborative behaviour may lead to adversarial culture and performance losses (Das and Teng 2011). Thus has prominent role in managing relational risk. The negative side of collaboration risk stem from multidisciplinary and multi location fragmentation, price competition, and poor communication and ultimately, from the temporary multi organizational nature of project delivery team (Cherns and Bryant 1984).

In conjunction, British Standard Institute (1991) defines risk as “a combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence”, or as a combination of likelihood of occurrence of a certain problem with the corresponding value, i.e. impact, of the damage caused.

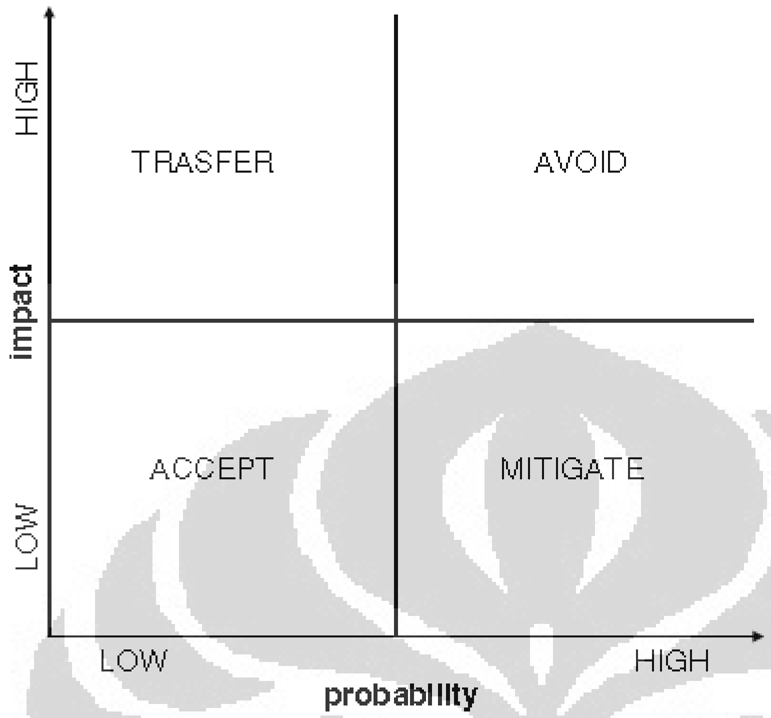
Accordingly, Nguyen and Prasanta (2007) presented the top ten major risks in construction project in the related field:

1. Bureaucratic government system and long project approval procedure
2. Poor design
3. Incompetence project team
4. Inadequate tendering
5. Late internal approval process from the owner
6. Inadequate project organization structure
7. Improper project feasibility study
8. Inefficient and poor performance of constructors
9. Improper project planning and budgeting
10. Design changes

2.4.5. Risk allocation

The form of payment defines who take a risk if the final cost of construction activities is higher than the estimated cost. The most widely used form are fixed prices and cost reimbursement (Branconi and Loch, 2004)

Over the last decade, researchers and practitioners have recognized that relationships between clients and contractors play a significant role in successful project implementation. It has been argued that traditional contract do not support effective corporation in construction project (Kadefors, 2004).



(Source: The British Standard Institute)

Figure 5 Probability x Impact

Figure 5 are mainly the standardization which usually allocated throughout the project by the project stakeholder. This matrix can be used based on company liabilities and company costing expenditures.

Thus, collaboration through partnering has become popular during the last decade. Partnering is a project governance form, based on cooperative procurement procedures, that facilitates a stronger focus on cooperation than on competition (Eriksson, 2010). Cooperation between project actors is claimed to lead to fewer disputes, lower construction cost, and better quality product. Several studies have shown that practitioners are positive about collaborative relationships and believe that they lead to cost and risk reduction (Black et al., 2000; Akintoye and Main, 2007).

2.5 Summary

DT is generally loss time that could occurs on project lifecycle; this loss time could lead to loss of production time of a task or the overall project performance. DT could be managed by applying RM system as tools to measured and track the project outcome.

During marine operation there are uncertainties that need to be discovered due to the risk it contained. That risk should be accessed and can be seen as the following:

- The distance travelled to site can make a difference in the time of transportation of resources that include material and crew. This will automatically have significance on reaction time if there are some material or crew shortages that can affect the project.

- Hull and vessel capabilities also the main component of the operation. This will include the construction and support vessel that included in the operation. It relates to the vessel endurance during high seas or bad weather that usually happened in some area.

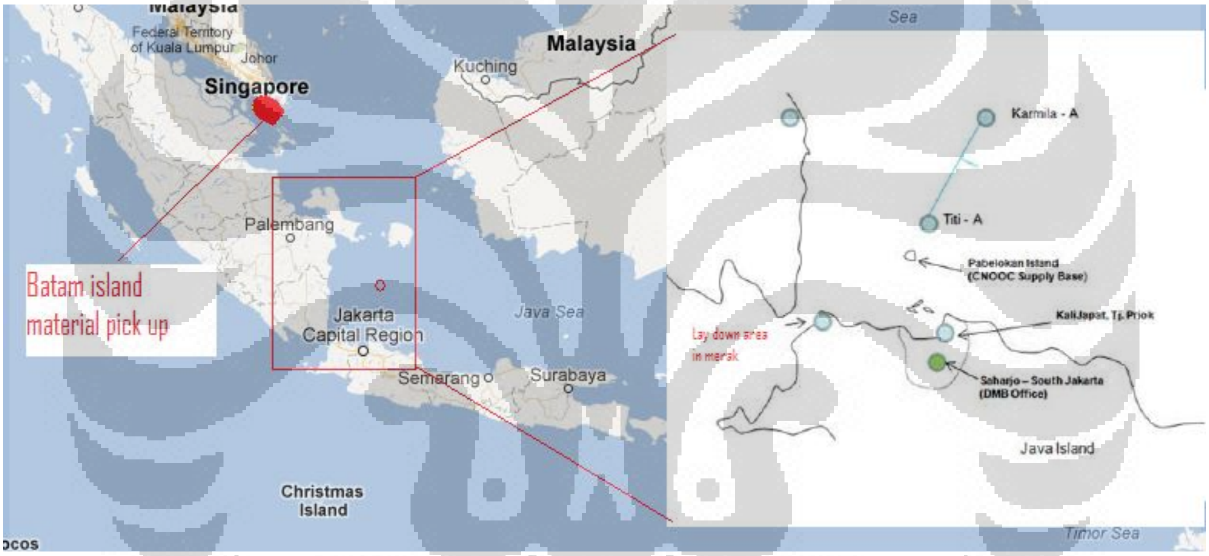
3. Case Study

3.1 Introduction

This chapter will generally explain the project briefs and the area of study that are conducted during the project timeframe. Furthermore the vessels that are used in this operation are the following: pipe-lay barge, crane and accommodation barge, anchor handling tugs, supply vessel, material barge.

3.2 Project Brief

The project that has been the subject of study in this writing is located in the north of Pabelokan Island which can be seen in the figure 6. This project is mainly to install a subsea pipeline from Titi-A platform to Karmila-A platform that include a T-junction in between the platform. Furthermore the pipes are already supplied by the client and to be picked up in Batam Island.



(Source: Project Documentation)

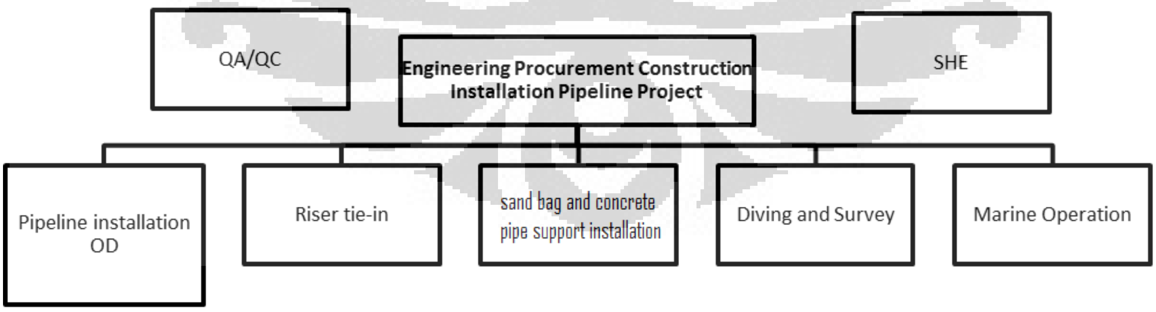
Figure 6 Project Location

Name:	Offshore Installation 16” sub-sea pipeline from Karmila-A to Titi-A
Location:	North of Pabelokan Island
Client:	CNOOC SES Ltd
Project Timeline:	August 2009-May 2010
Project Main Scope:	• 16” OD Pipeline including riser on both platform • T-junction and subsea tie-in to existing 6” OD pipeline • Installation of sand bag, and concrete pipe support • Pigging and hydro test • Material Handling from Batam island to lay down area and transfer to site

(Source: Company Contract Document)

Figure 7: Project Scope of Work

A work breakdown structure and all pieces of work involved in the project can be seen in the Figure 8. This was then used to assist in developing both the schedule and cost baseline. The contract is based to compensate the progressed and earned work in accordance with the key event milestone; Lump sum and provisional sums compensation. The change works will be compensated on a unit rate or daily rate basis.



(Source: Company Database)

Figure 8 : Project structure diagram

Figure 8 are generally the brief of scope of work done in this project. Furthermore the transportation are a critical factor in the operation. The limitations of the scope are the following:

1. Providing all construction and installation activities required for preparation, fabrication, joint coating as specified, transportation, barge positioning services, site installation, inspection, and pre-commissioning of the facilities
2. Providing all engineering procedures, detail drawings, calculation notes, list of contractor equipment and personnel, planning and contingency plan and procedures and equipment as necessary to perform the work
3. Providing all project management, procurement, supervision, labour, facilities, vessels, temporary and consumable materials, construction equipment and all other items (except company supplied free issued services and materials) necessary to complete the work.

3.3 Specific Area of Risks: Case Studies

Risk mitigation is mainly the intersections between RM, procurement plan, and also project schedule. From the risk point of view, the mitigation process every now and then can cause delays within the project, for example in this case study at DMB.

There are some issues which are usually triggered by vessel owner whose charter their vessel in bareback type, when in some case in happened frequently due to the lack of knowledge from the vessel owner on the equipment needed within the industry. For instance, the cable length of anchor where the information on the length differences, also the same perception and understanding within the workers, as well as meeting the owner rep is inadequate. The knowledge and information on different standards used by a company is also insufficient.

By using risk survey and overall assessment to manage the project outcome, will ensure the project done efficiently and to ensure the project's main objectives can be achieved on time, on budget and also maintaining the qualities.

Generally, the risk response planning is a start of the process to mitigate some of the risks that have already been defined in point risk identification and risk analysis. This process will be the basic input risk response and; risk monitoring and control which will be compared within the following chapter 4.

Risk response and; risk monitoring and control can be identified as a mitigation process in project management plan. It is an integral part of the project to control the changes which commonly happened in the project. This can be caused by a fault within the contract or in some cases the contracts have not been foreseen by the stakeholder in the project. This mitigation is an iterative process which can be seen in appendix-3. The process mainly explain risk continuum interaction diagram. This will mostly happen in each project as the time progress in each project. The risk mitigation process will have a bigger impact in the front, it will exponentially decreased by time to time. It will be affected by the term and contract of the project, even though the project management knowledge of areas is divided into:

- Scope management
- Time management
- Cost management
- Integration management
- Human resources management
- Communication management
- Risk management
- Procurement management

The built relationships are commonly categorized as a matrices which connected by some manner that cannot be dealt one by one. These responsibilities should be seen from a general view to guard the objectivity from each case and can be simplified by a matrices or set that intersect each of those knowledge area.

3.4 Contractor Point of View

The project time is mainly determined before the start of the project during the time of bidding. This time frame will probably change during the project phase. As the project goes to each phase forward in each phase the project knowledge will increased slightly to predict the project time frame that are manageable in time. If there are risks founded within the early phase estimation, then the options will be either fast tracking the project or lengthen the project time frame. This is commonly done by the contractor if the project is not a definitive in term of project installation time frame. These terms are mostly not acceptable in the oil and gas industries, since they already have tight schedules during some major projects. The most probable cause of this issue is for the reason that the owner has several contractors working at the same time and in the same site. Based on that assumption, most oil and gas industry companies have some time frame that cannot be negotiated. When this happened, the industry will severe from the loss of production time. This lost production time is usually dealt by fast tracking the project.

In general, the cause of time loss can be categorized as the following: safety related accident, health, and environmental accident. Those three are the main concerned that can make some of the project to be halt in some case. These are the main important reason which makes risk mitigations crucial for contractor's point of view.

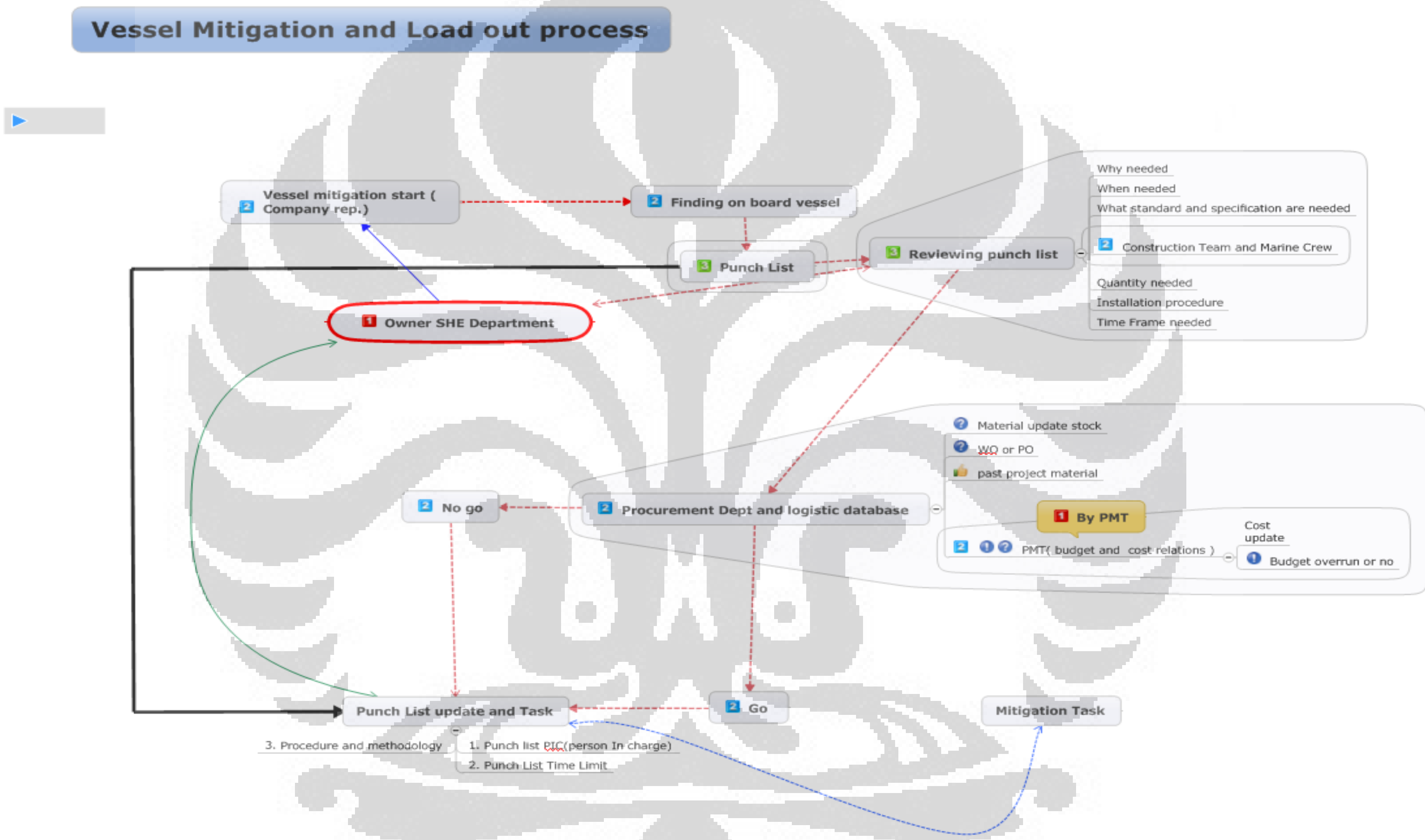
The other major concern to the contractor is the cash flow which has been predicted before. It could change the project outcome in some manner. If by some reason the cash flow is not fulfilled, then the project might have difficulties and moreover can lead to project halt. This halt of project cannot be barred by all means. The projects cash flow can be determined and predicted by factors include:

- Scope determination
- Material take off and procurement strategies
- Payment method by owner
- Construction contract type

- Project expediter
- Project income from invoice progress
- Bank payment

3.5 Risk Mitigation Procedure

Risk mitigation process before mobilization time can be seen in figure 9. This process is mainly to obtain permit and mobilization authorisation from client or government.



(Source: Company Process flow)

Figure 9: Mitigation Process

During the risk mitigation process (figure 9), there will be probability of increased cost. Commonly this will be updated to the overall budget, which using a contingency budget that are predefined at the earliest time of the project before the project starts. The diagram is most common thing that has been done in the DMB. Those will have some relation with the project outcome and project total cost. Those costs are will have to be updated and weight based on case by case that are based on bellow figure to completely manage the project outcome. These will ensure the client and all project team based on the project objectives and contract.

Furthermore risk amount at stake are higher in front of the project due to uncertainties. Like most marine project the vessel charter cost is the main thing that related to cost. Other than that the Marine Fuel Oil (MFO) are the second thing that are related to cost. Risk mitigation should be done to ensure the production times of the construction are made in the right way and on the right time.

From the work breakdown structure (WBS) we can see each activity and how the material take off Material Take Off (MTO) are built. For each activity there will be a material, equipment, and labour cost that will form a direct cost. Furthermore, this direct cost will govern the indirect costs like insurance and overheads. After each WBS has its own component that is built up, its baseline price we will have to add some of equipment that will be used together for several activity. This activity is mainly the work that will be carried out offshore (at sea). There will be three marine spreads (set of ships) that will be used to carried out the work (i.e.: for marine pipeline installation the vessel that will be used are pipe lay barge, material barge, and two anchor handling tugs).
Because most of the work that carried out in the sea will be in 24 hour basis, it will consist of three shifts of crew at all time. The most cost will come from vessel charter, labour for three shifts and fuel for vessel. The vessel charter usually does not include fuel; it is the ship and its crew only. From that point of view there is key point which was the following:

- A contingency plan will be required and to allow for delays what will mainly be caused by weather. The work that will be carried out at sea will have risk of stopping if rough seas occur during the time of construction. Under water work and pipe-laying activities will be stopped when rough seas occur for safety reasons.
- There will be some overhead cost for training of the labourer and manpower that will be working at sea which consist of helicopter rescue training, sea survival, and some training to comply with the company regulation which in some case are oil producer.

From above point we can said that all the criteria in mitigation process are to be made to fulfils the outcome of the project overall. Furthermore responsibility is based on the contract which was the project contract. Even though contracts are already made and sign in kickoff meeting this will have to be change from time to time depending on the situation of the risks that are foreseen to guard everyone interest and to fulfils the main objectives of project. Example that in this case to connect the two platforms to ensure the production can be run smoothly without accident.

Contingency plan are already included in most project plan. Further, in the marine or offshore project are prone to down time. The scale of escalation of the cost is most likely in exponential numbers. This is mainly caused by the DT to keep station keeping the armada on site during the DT.

Criteria

Risk criteria of the risk mitigation process can be seen in Figure 9. The criteria are based on risk identifying listing, risk impact assessment that already done above. The criteria are basically the following to make a decision to make a correct one.

Mitigation reaction based on risk level

Risk level is determined by the project team to ensure the project objectives and project charter to be fulfilled. Risk level is following:

- Loss of Human Life (Unnecessary)
- Loss of Time (Down time due to prediction and forecast)
- Loss of Resources

Mitigation responsibility

Mitigation responsibilities are can be seen in the project Responsible Assignment Matrices inform (RACI) chart that already done in the project. Those RACI chart can be a guideline to managed responsibility for each project team that are included in the project team. Furthermore the RACI chart can be seen in the Appendix-1.

3.6 Project Deliverables

The project deliverables that have already been registered will have to comply with the specification and regulation set by the company. This hand over documents can be delivered separately for each facility or in whole as one. Each hand over of facilities included in this project will must or shall consist of this following item:

- Installation procedures
- As built drawings
- Engineering calculations for the installation and operation

This sub-chapter will explain about how the cost baseline was made and how it will be used to control the project budget to be on budget. To understand how to control the budget, an understanding of how the budget is formed and built in the first place is needed.

Based on those criteria above marine operation for pipeline are mostly like running a fabrication or plant on the sea. The production time should be guard to fulfil the target time. Furthermore, compliance and testing is the last thing that needs to be considered.

3.7 Issues and Finding

Findings are mostly some problem that might occur during the project which can cause a problem in the project or not. Issues are defines as some issues that can cause a major or significance outcome and need to be taken care as soon as possible. Findings can be turn to be a Issues and need to be taken care after Issues escalation response that already been define by the PMT. These responses are included in the project communications system and project risk response. Those response are mainly can be closed out by health, safety, and environmental (HSE) department and the DMB PMT.

There are some findings during the project time frame that will be divided into two section bellow. Most issues can be categorized as issues and finding as follows:

Before Mobilization

Most of finding that are know from previous similar project are listed and to be check before the mobilization time. This includes all the vessel, machinery, equipment, crew, and material that need to be on site on the timeline. Even though some minor equipment that are not available during mobilization time can be shipped to site during the crew change timeline. This usually is consumable materials that sometimes lost during rough weather or storm.

After Mobilization (During Marine Operations)

During this timeline most finding can be categorized and process to become issues that had been resolved or not. Material shortages on consumable are mostly happened due to redundancy of communication and routing that usually happened between head offices and site offices which in this case are site engineer and marine crew. This redundancy are happening mostly due to structural of the organization that involved in the project are several sub-contractor that happened not reporting the company representative in site.

4. Discussion

4.1 Mitigation outcome

From previous chapter we can see the process flow how RM done specifically in the vessel and marine spread before mobilisation to site. These processes are mainly done in order to obtain permit from the client and regulatory board in order to enter client area. The mobilisation can only be done with closing of the punch list and finding closing by the client representative wether on site or at the office. Those finding are mostly vessel based on client standard which usually are found by the third party representing the client that act as surveyor.

4.2 Overall Mitigation Outcome

The outcome of the process will have close relationships that will have a complicated effect on the overall project outcomes. This risk mitigation process is done by the RM team as it will interrelate from the 10 areas mentioned before. This process will then be controlled and documented by integration management.

From the previous chapter we can see how mitigation process are related to the outcome of the project wether it was the cost or/and time. Those factors are related to each other which in this case the construction are done in the sea. This will have a large amount of significance due to the field that mostly are remote and prone to weather change. Furthermore high swell are likely to happen. For most of that cause there will be a time difference between site office which in this case are located in the work barge ,accommodation barge, and also all the vessel that are been used in h project.

4.3 Cost Variance

This section is prepared to introduce a brief outline of the control procedure covering cost control, change and variation control, control of reimbursable and reporting. Contractor cost control procedures are categorised to be applicable to the following three compensation types of contract including:

- Lump sum compensation
- Unit rate base or reimbursable compensation
- Combined compensation by lump sum and unit rate or reimbursable

Variations are usually to be made in project without changing the project objectives. Furthermore, these changes should be documented by related party which in this case company, DMB, sub-contractor, and other that affiliates and takes part on the project.

4.4 Mitigation Cost Recap

Cost recap are done by the PMT in this case project finance, project manager (PM), and procurement. This will ensure the cost recap is done right. Cost recap and cost mitigation will usually have a certain effective point that are will ensure the project are on budget and on time without forgetting the quality that it has been designed. Cost recap should be done in weekly basis on site, 2 week by PM and finance team.

5. Conclusion

5.1 Conclusion

From the previous chapter it can be concluded there are some major risks which are the following:

- Mobilization delay which are caused by several subcontractor which happened not to actively communicate with the company regarding their equipment and machinery that need to be secured on board the construction barge and/or pipe laying barge during mobilisation time or crew change time frame. Furthermore this are mainly related to ship stability durring high sea states. To response this kind of delay it is mostlikely to better control subcontractor equipment and personel on board company vessel.

- Permits approval delay by the related authorities can lead to change of weather if the time is in storm season in the area.

- Crew and material delay which caused by badweather, this could lead to downtime which can be a major risk and delay. To response this kind of delay it is mostlikely to get a bigger supply vessel that are more can withstand badweather ie: more horsepower and deck space.

Even though there is some minor difference in the site productivity which counted as cost risk that happened during the operation. The actual cost and risk that actually occurs in the company had some minor difference with some fluctuation in start of the project. This usually happened due to new crew or new project management team in this project.

5.2 Recommendation

Some recommendations that are visible are mostly the following:

- More accurate and quick response between the company rep onsite and offsite (head office).
- More accurate writing between the client representative and company representative on site, offsite, and on the load out jetty.

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Appendices

Appendix-1 Stakeholder Responsibility Table

Stakeholder	Responsibility
Business Unit Managers and Service Unit Managers	Ensuring that no activity takes place at company or contractor facilities where they have authority until such a time as the hazards have been assessed and control measures put in place.
Senior Company man at location, safety inspectors and Business Unit and Service Unit Health and Safety E representatives	Ensuring all activities are assessed and control measures established, personnel are trained in the requirements and for reporting results of assessments to HSE and user groups. They are further responsible for ensuring assessments are current and kept up to date. Senior company man at location is further responsible for ensuring that no activity takes place until such time as the hazards have been assessed, control measures put in place and the SOP reviewed
Health, Safety and Environmental Division	Providing specialist help to locations in conducting assessments and other techniques when requested to do so, for maintaining records and for reviewing the effectiveness of assessments
Supervisors	Ensuring that personnel are trained and familiar with the control measures for the activity in hand and for ensuring that no activity commences until the control measures have been established.
All Employees	Must comply with the requirements of this procedure.

Position	Responsibilities	Authority	Competencies	Qualification
Project Manager	Manage budget, scheduling, procurement. 8 facets of project management. Report to client.	Highest level of authority	Vast experience in previous similar projects.	Tertiary education degree
Project Engineer	Manage budget, scheduling, procurement	Highest level of authority besides PM	Vast experience in previous similar projects	Tertiary education degree
Site Engineer	Scheduling, quality, procurement, risk	Authority over sub-contractors	Experience in previous similar projects	Tertiary education degree
Environmental Engineer	Ensure the environmental controls and managed	Authority over sub-contractors	Experience in this role in previous similar projects	Tertiary education degree
Foreman	Management of works and personnel on site	Authority over sub-contractors	Experience in this role in previous similar projects	Trade based qualification
Quality Inspector	Ensure the quality of works on site	Authority over sub-contractors	Experience in this role in previous similar projects	Experience based
Safety Co-ordinator	Ensure the safety controls are in place and managed	Authority over sub-contractors	Experience in this role in previous similar projects	Tertiary education
Project Administrator	Manage finances	Authority over all staff except PM and Proj Eng	Experience in this role in previous similar projects	Experience based

Appendix-2 Probability and Impact Scoring and Assessment Tables

Qualitative Probability Scoring	Quantitative Probability Scoring/Rating (P)
Highly Unlikely	0.1
Unlikely	0.3
Possible	0.5
Moderate Probable	0.7
Highly Probable	0.9

Probability Assessment Based on Max Wideman Issacons method

Qualitative Impact Scoring	Quantitative Impact Scoring/Rating (I)
Insignificant	0.05
Moderate	0.10
Medium	0.20
Severe	0.40
Catastrophic	0.80

Impact Assessment Based on Max Wideman Issacons method

Defined Conditions for Impact Scales of a Risk on Major Project Objectives (Examples are shown for negative impacts only)					
	Relative or numerical scales are shown				
Project Objective	Very low /.05	Low /.10	Moderate /.20	High /.40	Very high /.80
Cost	Insignificant cost increase	<10% cost increase	10-20% cost increase	20-40% cost increase	>40% cost lincrease
Time	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time ilncrease	>20% time increase
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
Quality	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

Risk Level Scoring and the Effect to Project

Appendix-3 Risk Register

Risk ID	Risk Name	Related Activity	Description of risk	Description of Impact	Impact Rating (I)	Likelihood Rating (P)	I x P	Risk Level	Prevention Action
1	Mislead Material Lashing	Load out; mobilisation	The material did not lashed properly after the mobilisation on the vessel	worker injury; material loss; ship stability issue	0.4	0.1	0.04	Very Low	Double Check the Lash and the turnbuckle
2	Pipe Support Wrong Placement	Concrete block installation; sandbag installation	The pipe support is not located at the proper location	material loss; schedule overrun	0.2	0.3	0.06	Very Low	Pipe Support Placement with GPS, Survey Mapping, and Bachtimetry test assistance; Making reference point every 400 m
3	Pipe Transfer Accident	Mobilisation; Pipe Transfer	Material falls during pipe transfer	material loss; worker injury; death; damaged the ship	1	0.1	0.1	Low	Ensuring the crane is examined by a competent person; Crane Certification; Operated by Licensed and certified Operator

Risk ID	Risk Name	Related Activity	Description of risk	Description of Impact	Impact Rating (I)	Likelihood Rating (P)	I x P	Risk Level	Prevention Action
4	Unaligned Weld positioning	Weld	Unaligned weld Positioning due to the human error or mechanical error	material loss; cost overrun; schedule overrun; worker injury	0.2	0.1	0.02	Very Low	The weld device is operated by licensed and certified operator; ensuring the connection aligned before weld; The weld device maintained regularly; Personal Protection Equipment
5	Non-Destructive Test (NDT) mistake	NDT	The does not run properly which leads to undetected material	cost overrun; pipe leakage; project failure	1	0.1	0.1	Low	NDT should be done by certified and licensed operator; Regular maintenance on NDT device
6	Coating Failure	Coating	The coating is not strong and brittle, or easy to break	material loss; cost overrun; schedule overrun	0.1	0.5	0.05	Very Low	Certified and licensed operator needed; asphalt composition should mantained well
7	Pipe cutting mistake	Pipe Cutting	The last pipe is cut shorter or longer than it is needed	material loss; schedule overrun; cost overrun;	0.4	0.3	0.12	Low	Surveying aligns the actual condition and plan; Cutting is done carefully

Risk ID	Risk Name	Related Activity	Description of risk	Description of Impact	Impact Rating (I)	Likelihood Rating (P)	I x P	Risk Level	Prevention Action
8	Fabrication Delay	Fabrication; Mobilisation	Transportation delay from vendor; fabrication delay	Schedule overrun	0.4	0.5	0.2	Moderate	The vendor selection based on quality; Good scheduling planning; Clear contract and payment with vendor
9	Steel Wire Damage	Winch Installation	The steel wire is broken or damaged due to the age	Schedule overrun; damaging the material	0.4	0.5	0.2	Low	Always use new steel wire for each project; Check the steel wire regularly during the project; Investigate the damage and report the damage
10	Steel Wire not aligned in position	Anchor positioning	The steel wire is not aligned properly as the drawing plan	schedule overrun; cost overrun; and possibly to project failure if the detection is late	1	0.1	0.1	Low	Anchor the ship properly; Always check the steel wire alignment every 3 days
11	Weak soil at anchor point	Anchor positioning	The soil type is classified as weak soil which gives more chance to landslide	Schedule overrun; Material loss; cost overrun	0.2	0.7	0.14	Low	Proper soil investigation before the soil placement and followed by choosing the suitable foundation

Appendix-4 Interview Form

Interview Form

Name:	Puthut karibowo
Project Title:	~~Provision~~ Project manager
Project Name:	Provision of offshore pipeline melahin to kerindingan (8" two lines)
Keypoint of Interview:	* logistical delay * procurement plan * comunication interface
Background expirience:	Teknik Kelautan, QA/QC, Project Manager

Remarks,

PT DWISATU MUSTIKA BUMI
DMB
JAKARTA

Interview Form

Name:	S. Halim
Project Title:	Project Director
Project Name:	CNOOC EPCI Pipeline Replacement 16"
Keypoint of Interview:	* Down time management * Cost update & ~~interface~~ inter project interface
Background expirience:	mechanical in ship & tanker; pipeline & mooring

Remarks,

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S. HALIM

Interview Form

Name:	Cahyadi Alamsyah
Project Title:	Project manager
Project Name:	Cnooc EPCI pipeline Replacement 16"
Keypoint of Interview:	* mobilization delay during mitigation * logistic delay during hydrotest
Background expirience:	Bussines Development manager, VP operation, mechanical

Remarks,

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DMB
JAKARTA

Appendix-5 Note

Due to copyright and company policy the Risk registered in this writing is only a fraction of the complete project database. This are mainly due to aim of this thesis which was academic usage.